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ERRATA

Annual Report to the Governments
of the United States and Canada

Columbia River Treaty
Permanent Engineering Board

30 September 1985

Page 15 - last line should read "on 31 December 1984."

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

CANADA · UNITED STATES

CANADIAN SECTION
G.M. MacNABB, Chairman
B.E. Marr, Member

UNITED STATES SECTION
L.A. DUSCHA, Chairman
J.E. Harper, Member

31 December 1985

The Honorable George P. Shultz
The Secretary of State
Washington, D.C.

The Honourable Pat Carney
Minister of Energy, Mines and Resources
Ottawa, Ontario

Reference is made to the Treaty between the United States of America and Canada, relating to co-operative development of the water resources of the Columbia River basin, signed at Washington, D.C., on 17 January 1961.

In accordance with the provisions of Article XV paragraph 2(e), there is submitted herewith the twenty-first Annual Report, dated 30 September 1985, of the Permanent Engineering Board.

The report sets forth results achieved and benefits produced under the Treaty for the period from 1 October 1984 to 30 September 1985.

Respectfully submitted:

For the United States

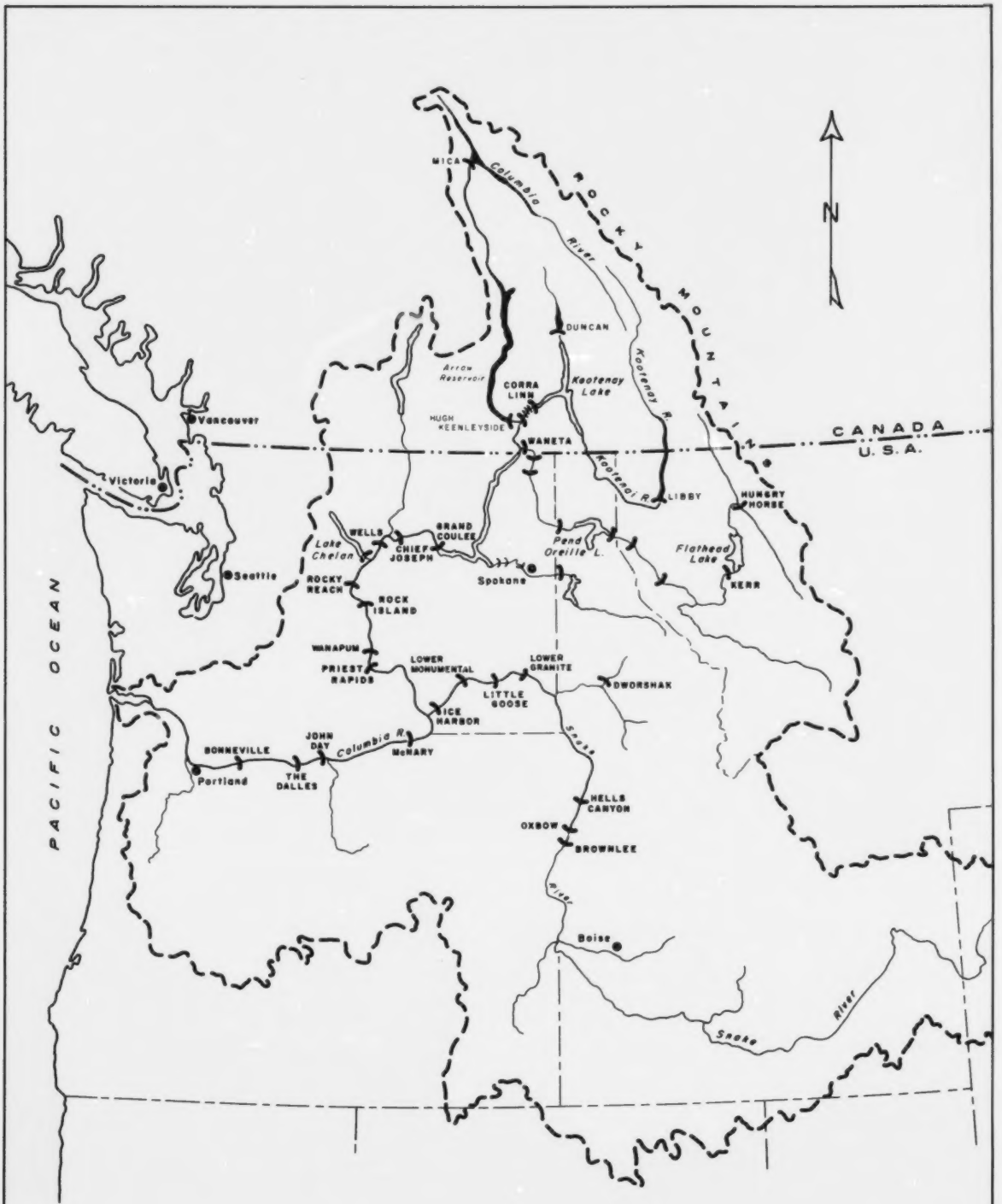
Lloyd A. Duscha, Chairman

J. Emerson Harper

For Canada

G.M. MacNabb, Chairman

B.E. Marr



COLUMBIA RIVER BASIN

ANNUAL REPORT
to the
GOVERNMENTS
of
THE UNITED STATES and CANADA

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

Washington, D.C. **Ottawa, Ontario**

30 September 1985

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Photographs supplied by the British Columbia Hydro and Power Authority, the Government of British Columbia, and the U.S. Army Corps of Engineers.

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SUMMARY

The twenty-first Annual Report of the Permanent Engineering Board is submitted to the Governments of the United States and Canada in compliance with Article XV of the Columbia River Treaty of 17 January 1961. The status of projects, progress of Entity studies, operation of Duncan, Arrow, Mica and Libby reservoirs, and the resulting benefits are described.

The Duncan, Arrow, Mica and Libby storage projects were operated throughout the year in accordance with the objectives of the Treaty and the terms of operating plans developed by the Entities. An agreement between the Entities relating to the use of non-Treaty storage and refill enhancement of Mica and Arrow reservoirs did not conflict with Treaty operations. Although reservoir operations reduced peak freshet flows, the unregulated peaks would only have caused minor flood damages in either country. (Pages 27-34)

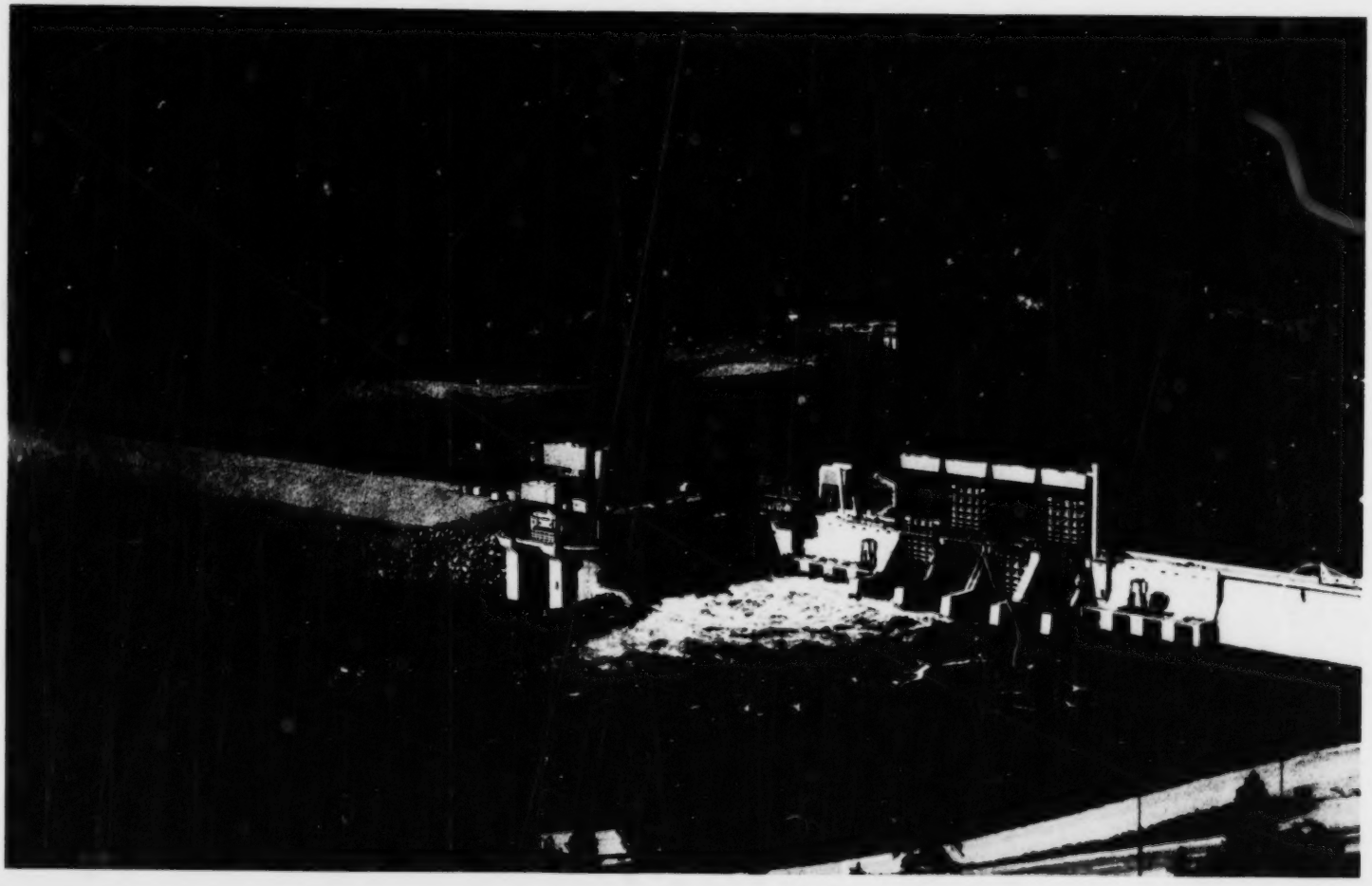
Studies pertaining to development of the hydrometeorological network and power operating plans are being continued by the Entities to ensure operation of the projects in accordance with the terms of the Treaty. Annual calculations of downstream power benefits are proceeding and the Entities are studying issues affecting future development of the Assured Operating Plans and calculation of the Downstream Power Benefits, including water budget and updated streamflows, and will report results. (Pages 21-25)

The Board concludes that the objectives of the Treaty are being met.

INTRODUCTION

The Columbia River Treaty, which provides for cooperative development of the water resources of the Columbia River basin, was signed in Washington, D.C. on 17 January 1961 by representatives of the United States and Canada. Article XV of the Treaty established a Permanent Engineering Board and specified that one of its duties would be to "make reports to Canada and the United States of America at least once a year of the results being achieved under the Treaty . . ."

This Annual Report, which covers the period 1 October 1984 to 30 September 1985 describes activities of the Board, progress being achieved by both countries under the terms of the Treaty, operation of the Treaty projects, and the resulting benefits. The report states that, in the opinion of the Board, the objectives of the Treaty are being met. Summaries of the essential features of the Treaty and of the responsibilities of the Board and of the Entities are included.



HUGH KEENLEYSIDE DAM Columbia River, British Columbia
Concrete spillway and discharge works with navigation lock and earth dam.

THE COLUMBIA RIVER TREATY

General

The Columbia River Treaty was signed in Washington, D.C. on 17 January 1961 and was ratified by the United States Senate in March of that year. In Canada ratification was delayed. Further negotiations between the two countries resulted in formal agreement by an exchange of notes on 22 January 1964 to a Protocol to the Treaty and to an Attachment Relating to Terms of Sale. The Treaty and related documents were approved by the Canadian Parliament in June 1964.

The Canadian Entitlement Purchase Agreement was signed on 13 August 1964. Under the terms of this agreement Canada's share of downstream power benefits resulting from the first thirty years of scheduled operation of each of the storage projects was sold to a group of electric utilities in the United States known as the Columbia Storage Power Exchange.

On 16 September 1964 the Treaty and Protocol were formally ratified by an exchange of notes between the two governments. The sum of $253.9 million (U.S. funds) was delivered to the Canadian representatives as payment in advance for the Canadian entitlement to downstream power benefits during the period of the Purchase Agreement. On the same date at a ceremony at the Peace Arch Park on the International Boundary the Treaty and its Protocol were proclaimed by President Johnson, Prime Minister Pearson, and Premier Bennett of British Columbia.

Features of the Treaty and Related Documents

The essential undertakings of the Treaty are as follows:

(a) Canada will provide 15.5 million acre-feet of usable storage by constructing dams near Mica Creek, the outlet of Arrow Lakes and Duncan Lake, in British Columbia.

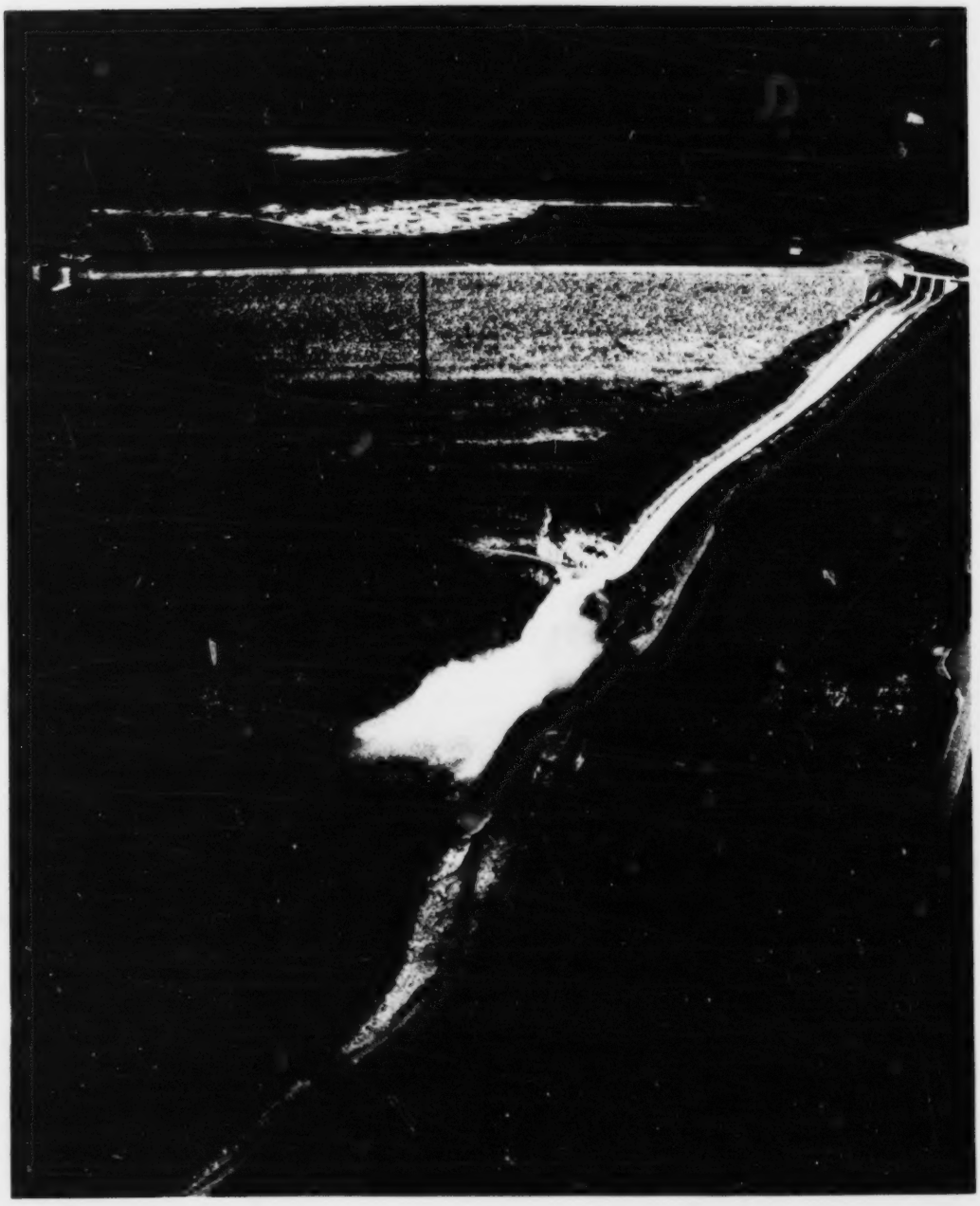
(b) The United States will maintain and operate hydroelectric power facilities included in the base system and any new main-stem projects to make the most effective use of improved streamflow resulting from operation of the Canadian storage. Canada will operate the storage in accordance with procedures and operating plans specified in the Treaty.

(c) The United States and Canada will share equally the additional power generated in the United States as a result of river regulation by upstream storage in Canada.

(d) On commencement of the respective storage operations the United States will make payments to Canada totalling $64.4 million (U.S. funds) for flood control provided by Canada.

(e) The United States has the option of constructing a dam on the Kootenai River near Libby, Montana. The Libby reservoir would extend some 42 miles into Canada and Canada would make the necessary Canadian land available for flooding.

(f) Both Canada and the United States have the right to make diversions of water for consumptive uses and, in addition, after September 1984 Canada has the option of making for power purposes specific diversions of the Kootenay River into the headwaters of the Columbia River.



MICA DAM Columbia River, British Columbia
The earth dam with spillway in operation. The underground powerhouse is at the left.

(g) Differences arising under the Treaty which cannot be resolved by the two countries may be referred by either to the International Joint Commission or to arbitration by an appropriate tribunal as specified by the Treaty.

(h) The Treaty shall remain in force for at least 60 years from its date of ratification, 16 September 1964.

The Protocol of January 1964 amplified and clarified certain terms of the Columbia River Treaty. The Attachment Relating to Terms of Sale signed on the same date established agreement that under certain terms Canada would sell in the United States its entitlement to downstream power benefits for a 30-year period. The Canadian Entitlement Purchase Agreement of 13 August 1964 provided that the Treaty storages would be operative for power purposes on the following dates:

Duncan storage	1 April 1968
Arrow storage	1 April 1969
Mica storage	1 April 1973

PERMANENT ENGINEERING BOARD

General

Article XV of the Columbia River Treaty established a Permanent Engineering Board consisting of two members to be appointed by Canada and two members by the United States. Appointments to the Board were to be made within three months of the date of ratification. The duties and responsibilities of the Board were also stipulated in the Treaty and related documents.

THE PERMANENT ENGINEERING BOARD
Seated (left to right): B.E. Marr, L.A. Duscha, G.M. MacNabb.
Standing: H.M. Hunt, T.L. Weaver, E.M. Clark, S.A. Zanganeh.
Absent: J.E. Harper, A. Shwaiko.

Establishment of the Board

Pursuant to Executive Order No. 11177 dated 16 September 1964 the Secretary of the Army and the Secretary of the Interior on 7 December 1964 appointed two members and two alternate members to form the United States Section of the Permanent Engineering Board. Pursuant to the Department of Energy Organization Act of 4 August 1977 the appointments to the United States Section of the Board are now made by the Secretary of the Army and the Secretary of Energy. The members of the Canadian Section of the Board were appointed by Order in Council P.C. 1964-1671 dated 29 October 1964. Each member was authorized to appoint an alternate member. On 11 December 1964 the two governments announced the composition of the Board.

The names of Board members, alternate members and secretaries are shown in Appendix A.

Duties and Responsibilities of the Board

The general duties and responsibilities of the Board to the governments, as set forth in the Treaty and related documents, include:

(a) assembling records of the flows of the Columbia River and the Kootenay River at the Canada-United States of America boundary;

(b) reporting to Canada and the United States of America whenever there is substantial deviation from the hydroelectric and flood control operating plans and if appropriate including in the report recommendations for remedial action and compensatory adjustments;

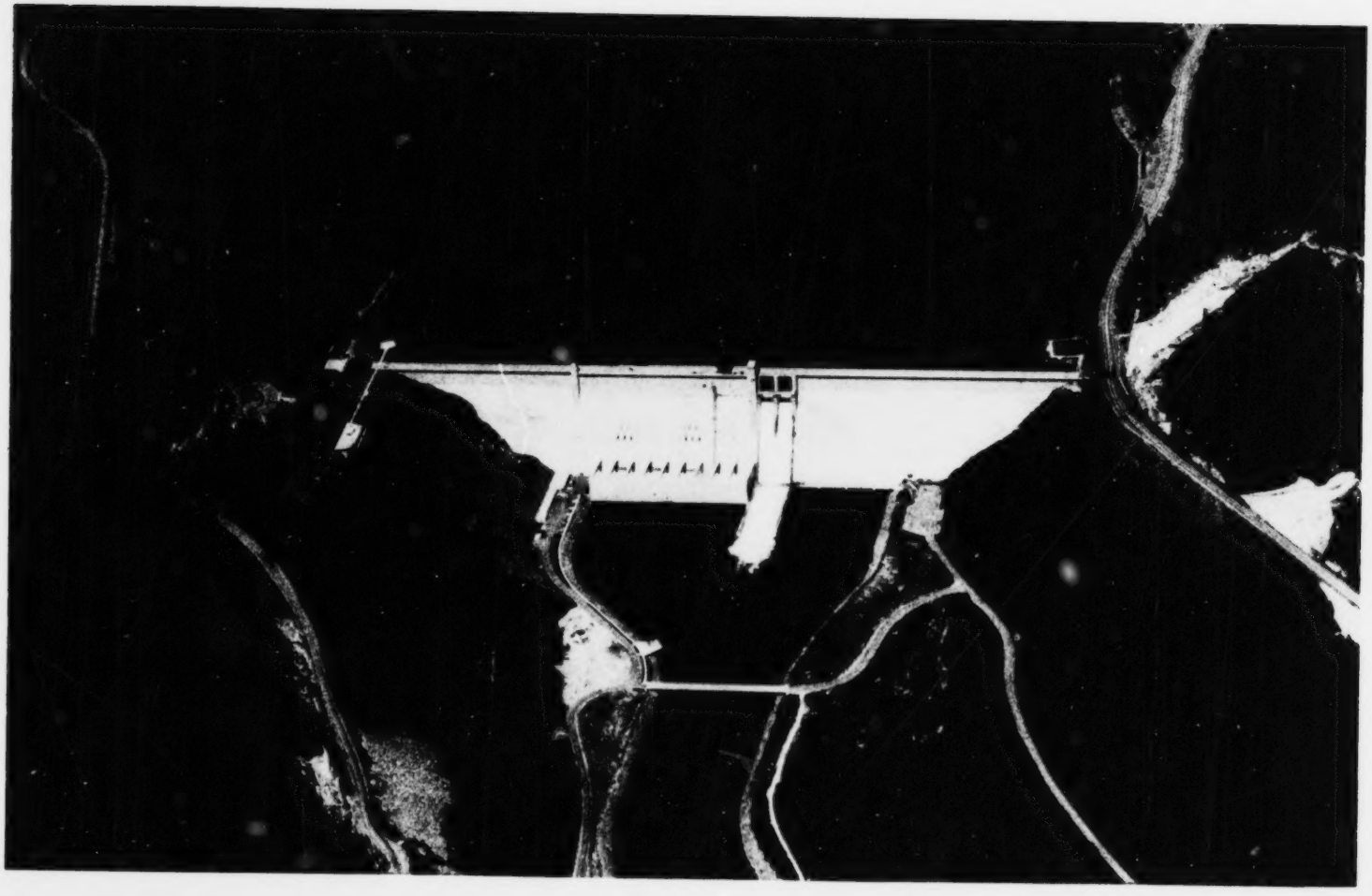
(c) assisting in reconciling differences concerning technical or operational matters that may arise between the entities;

(d) making periodic inspections and requiring reports as necessary from the entities with a view to ensuring that the objectives of the Treaty are being met;

(e) making reports to Canada and the United States of America at least once a year of the results being achieved under the Treaty and making special reports concerning any matter which it considers should be brought to their attention;

(f) investigating and reporting with respect to any other matter coming within the scope of the Treaty at the request of either Canada or the United States of America;

(g) consulting with the entities in the establishment and operation of a hydrometeorological system as required by Annex A of the Treaty.



LIBBY DAM
The dam and reservoir, Lake Koocanusa. The powerhouse is at the left of the spillway.

Kootenai River, Montana

ENTITIES

General

Article XIV(1) of the Treaty provides for the designation by Canada and the United States of entities which are empowered and charged with the duty of formulating and executing the operating arrangements necessary to implement the Treaty. Provision is made for either government to designate one or more entities. The powers and duties of the entities are specified in the Treaty and related documents.

Establishment of the Entities

Executive Order No. 11177, previously referred to, designated the Administrator of the Bonneville Power Administration, Department of the Interior, and the Division Engineer, North Pacific Division, Corps of Engineers, Department of the Army, as the United States Entity with the Administrator to serve as Chairman. Pursuant to the Department of Energy Organization Act of 4 August 1977 the Bonneville Power Administration was transferred to the Department of Energy. Order in Council P.C. 1964-1407 dated 4 September 1964 designated the British Columbia Hydro and Power Authority as the Canadian Entity for the purposes of the Treaty.

The names of the members of the two entities are shown in Appendix B. It is noted that on 11 January 1985 Mr. C.A. Johnson succeeded Mr. R.W. Bonner as Chairman of the Canadian Entity.

Powers and Duties of the Entities

In addition to the powers and duties specified elsewhere in the Treaty and related documents the Treaty requires that the entities be responsible for:

(a) coordination of plans and exchange of information relating to facilities to be used in producing and obtaining the benefits contemplated by the Treaty,

(b) calculation of and arrangements for delivery of hydroelectric power to which Canada is entitled for providing flood control,

(c) calculation of the amounts payable to the United States for standby transmission services,

(d) consultation on requests for variations made pursuant to Articles XII(5) and XIII(6),

(e) the establishment and operation of a hydrometeorological system as required by Annex A,

(f) assisting and cooperating with the Permanent Engineering Board in the discharge of its functions,

(g) periodic calculation of accounts,

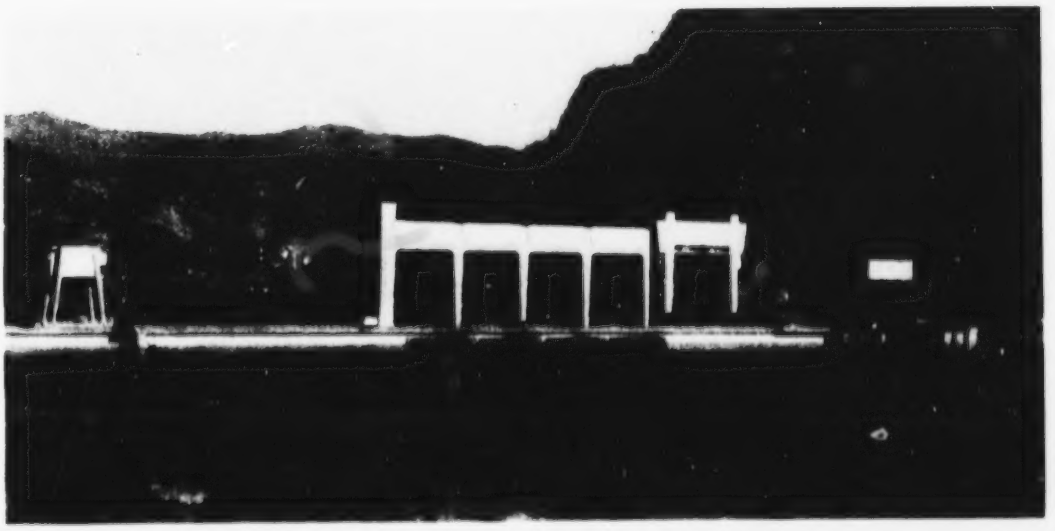
(h) preparation of the hydroelectric operating plans and the flood control operating plans for the Canadian storage together with determination of the downstream power benefits to which Canada is entitled,

(i) preparation of proposals to implement Article VIII and carrying out any disposal authorized or exchange provided for therein,

(j) making appropriate arrangements for delivery to Canada of the downstream power benefits to which Canada is entitled including such matters as load factors for delivery, times and points of delivery, and calculation of transmission loss,

(k) preparation and implementation of detailed operating plans that may produce results more advantageous to both countries than those that would arise from operation under the plans referred to in Annexes A and B.

Article XIV(4) of the Treaty provides that the two governments may, by an exchange of notes, empower or charge the entities with any other matter coming within the scope of the Treaty.



HUGH KEENLEYSIDE DAM and Forebay.

ACTIVITIES OF THE BOARD

Meetings

The Board met in Vancouver, British Columbia on 28 November 1984 to review progress under the Treaty and to discuss preparation of the Board's Annual Report. The Board met with the Entities on the same day to discuss Entity studies and general progress.

Reports Received

Throughout the report year the Canadian Entity provided the Board with weekly reports on operation of the Canadian storage reservoirs and with daily flow forecasts during the freshet season for the northern part of the Columbia River basin. The United States Entity provided monthly reports on the operation of the Libby storage reservoir. The Entities also provided copies of computer printouts of studies for the Assured Operating Plan and downstream power benefit calculations, and the following documents and reports:

- Report of Columbia River Treaty Canadian and United States Entities 1 October 1983 through 30 September 1984
- Columbia River Treaty Assured Operating Plan and Determination of Downstream Power Benefits for Operating Year 1989-90, plus a copy of the Entities' agreement on this document
- Detailed Operating Plan for Columbia River Treaty Storage 1 August 1984 through 31 July 1985, plus a copy of the Entities' agreement on this document
- Hydrometeorological Committee Documents, 1 November 1984, by the Columbia River Treaty Hydrometeorological Committee

— Report on Impact of Water Budget Flows on Assured Operating Plans and Determination of Downstream Power Benefits, 4 October 1984, by the Columbia River Treaty Operating Committee

— Report on Impact of Use of Updated Streamflow Records in Determination of Downstream Power Benefits, 4 October 1984, by the Columbia River Treaty Operating Committee.

Subsequent to the end of this report year, the Board received the following documents and reports from the Entities:

— Report of Columbia River Treaty Canadian and United States Entities 1 October 1984 through 30 September 1985

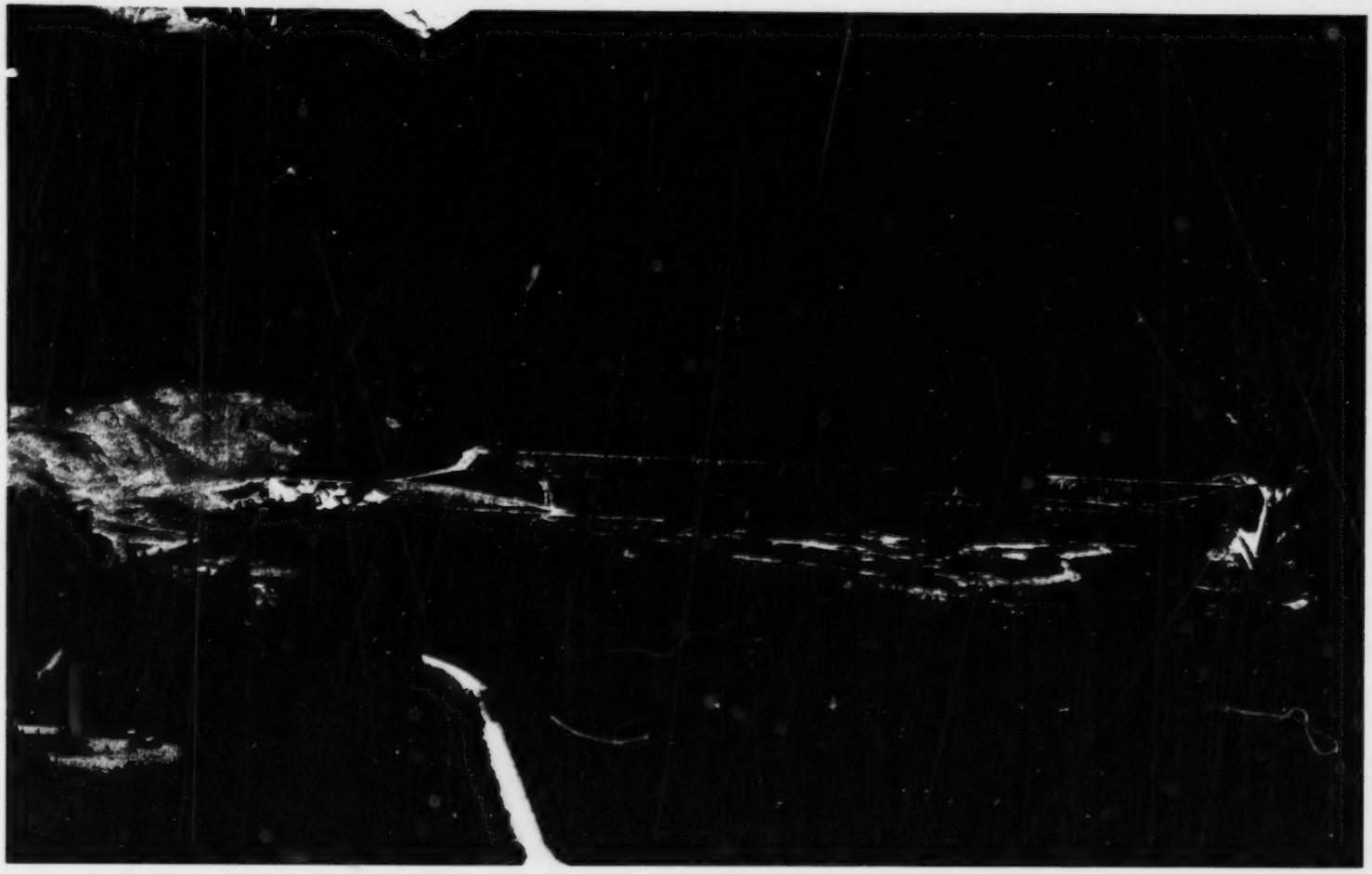
— Columbia River Treaty Assured Operating Plan and Determination of Downstream Power Benefits for Operating Year 1990-91, plus a copy of the Entities' agreement on this document

— Detailed Operating Plan for Columbia River Treaty Storage 1 August 1985 through 31 July 1986 plus a copy of the Entities' agreement on this document

— Revised Hydrometeorological Committee Documents, November 1985.

Report to Governments

The twentieth Annual Report of the Board was submitted to the two governments on 31 December 1982.



DUNCAN DAM
The earth dam with discharge tunnels to the left and spillway to the right.

Duncan River, British Columbia

PROGRESS

General

The results achieved under the terms of the Treaty include construction of the Treaty projects, development of the hydrometeorological network, annual preparation of power and flood control operating plans, and the annual calculation of downstream power benefits. The three Treaty storage projects in British Columbia, the Duncan, Arrow and Mica projects, produce power and flood control benefits in both Canada and the United States. The Libby storage project provides power and flood control benefits in both countries. In the United States increased flow regulation provided by Treaty projects has facilitated the installation of additional generating capacity at existing plants on the Columbia River. In Canada completion of the Canal Plant on the Kootenay River in 1976, installation of generators at Mica Dam in 1976-77 and the completion of the Revelstoke project in 1984 have caused power benefits to increase substantially. This amounts to some 4,000 megawatts of generation in Canada that may not have been installed without the Treaty. In addition, the installation of generating capacity at Hugh Keenleyside Dam and at the Murphy Creek Site near Trail, British Columbia is planned for the future.

The Treaty provides Canada with the option of diverting the Kootenay River at Canal Flats into the headwaters of the Columbia River commencing in 1984. British Columbia Hydro and Power Authority has completed engineering feasibility and detailed environmental studies of the potential diversion.

The locations of the above projects are shown on Plate 1 in Appendix D.

Status of the Treaty Projects

Duncan Project

Duncan Dam, the smallest Treaty project, was scheduled by the Sales Agreement for operation by 1 April 1968 and was the first of the Treaty projects to be completed. It became fully operational on 31 July 1967, well in advance of Treaty requirements.

The earthfill dam, about 130 feet high, is located on the Duncan River a few miles north of Kootenay Lake. The reservoir behind the dam extends for about 27 miles and provides 1,400,000 acre-feet of usable storage which is all committed under the Treaty. There are no power facilities included in this project.

The project is shown in the picture on page 16 and project data are provided in Table 1 of Appendix D.

Arrow Project

The Hugh Keenleyside Dam, at the outlet of the Arrow Lakes, was the second Treaty project to be completed. It became operational on 10 October 1968 well ahead of the date of 1 April 1969 scheduled by the Sales Agreement. The project at present has no associated power facilities, however, installation of generators is planned for the future.

The dam consists of two main components: a concrete gravity structure which includes the spillway, low-level outlets and navigation lock and an earthfill section which rises 170 feet above the riverbed. The reservoir, about 145 miles long, includes both the Upper and Lower Arrow Lakes, and provides 7,100,000 acre-feet of Treaty storage.

The project is shown in the picture on page 2 and project data are provided in Table 2 of Appendix D.

KINBASKET LAKE
and MICA DAM
seen from above.

Mica Project

Mica Dam, the largest of the Treaty projects, was scheduled by the Sales Agreement for initial operation on 1 April 1973. The project was declared operational and commenced storing on 29 March 1973.

Mica Dam is located on the Columbia River about 85 miles north of Revelstoke, British Columbia. The earthfill dam rises more than 800 feet above its foundation and creates a reservoir 135 miles long, Kinbasket Lake, with a storage capacity of 20,000,000 acre-feet. The project utilizes 12,000,000 acre-feet of live storage of which 7,000,000 acre-feet are committed under the Treaty.

The underground powerhouse has space for a total of six 434 megawatt units with a total capacity of 2,604 megawatts. The first two generators were placed in service late in 1976 and the last of the initial four units commenced operation in October 1977.

The project is shown in the picture on page 5 and project data are provided in Table 3 of Appendix D.

Libby Project in the United States

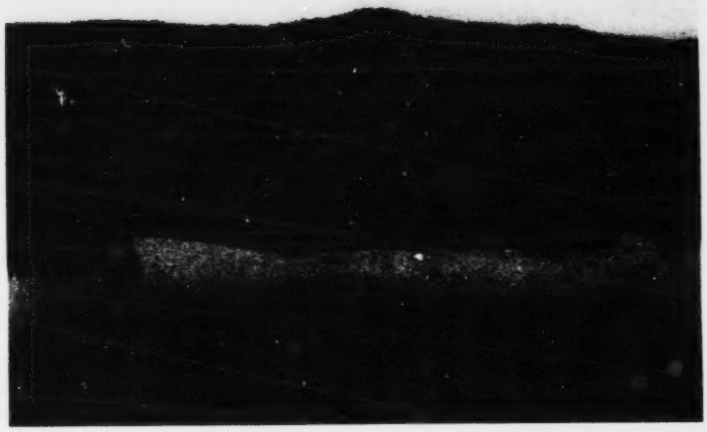
Libby Dam is located on the Kootenai River 17 miles northeast of the town of Libby, Montana. Construction began in the spring of 1966, storage has been fully operational since 17 April 1973, and commercial generation of power began on 24 August 1975, coincident with formal dedication of the project. The concrete gravity dam rises 370 feet above the riverbed and creates Lake Koocanusa which is 90 miles long and extends 42 miles into Canada. Lake Koocanusa has a gross storage of 5,869,000 acre-feet, of which 4,980,000 acre-feet are usable for flood control and power purposes. The Libby powerhouse, completed in 1976, had four units with a total installed capacity of 420 megawatts.

Construction of four additional units was initiated during fiscal year 1978 and the turbines have been installed. However, Congressional restrictions imposed in the 1982 Appropriations Act provide for completion of only one of these units. That unit is in place and the total installed capacity for the five units is 525 megawatts.

There has been no construction activity on the Reregulating Dam since that project was halted by court order in September 1978.

The Libby project is shown in the picture on page 10 and project data are provided in Table 4 of Appendix D.

LAKE KOOCANUSA
shoreline in Canada.



Libby Project in Canada

Canada has fulfilled its obligation to prepare the land required for the 42-mile portion of Lake Koocanusa in Canada. Responsibility for ongoing maintenance and clean-up of the reservoir has been turned over to British Columbia Hydro and Power Authority.

Hydrometeorological Network

One of the responsibilities assigned to the Entities by the Treaty is the establishment and operation, in consultation with the Permanent Engineering Board, of a hydrometeorological system to obtain data for detailed programming of flood control and power operation. This system includes snow courses, meteorological stations and streamflow gauges. The Columbia River Treaty Hydrometeorological Committee, formed by the Entities, makes recommendations on further development of the Treaty Hydrometeorological System.

In developing the hydrometeorological network, the Entities, with the concurrence of the Board, adopted a document in 1976 which defines the Columbia River Treaty Hydrometeorological System Network and sets forth a method of classifying facilities into those required as part of the Treaty System and those of value as Supporting Facilities. During the 1976-77 report year, the Entities, with the concurrence of the Board, adopted a plan for exchange of operational hydrometeorological data. That plan is still in force.

Early in this report year, the Entities provided the Board with a revised draft of the Hydrometeorological Committee Documents, dated 1 November 1984. After a joint review, the Entities modified the draft to identify the Treaty system facilities as distinct from support facilities. An updated document was provided to the Board after the end of the report year.

Work continued on addition of data collection platforms to improve communication within the Canadian Hydrometeorological Network. Work also continued in improving hardware and software for the Columbia River Operational Hydromet Management System (CROHMS) computer in Portland operated by the U.S. Army Corps of Engineers. Equipment which will enable CROHMS to receive data directly from satellites has been procured by the Corps of Engineers and will be installed in Portland late in 1985.

Power Operating Plans

The Treaty and related documents provide that the Entities are to agree annually on operating plans and on the resulting downstream power benefits for the sixth succeeding year of operation. These operating plans, prepared five years in advance, are called Assured Operating Plans. They represent the basic commitment of the Canadian Entity to operate the Canadian Treaty storage and provide the Entities with a basis for system planning. Canada's commitment to operate under an Assured Operating Plan is tied directly to the benefits produced by that plan. At the beginning of each operating year, a

Detailed Operating Plan which includes Libby reservoir is prepared on the basis of current resources and loads to obtain results that may be more advantageous to both countries than those which would be obtained by operating in accordance with the Assured Operating Plan.

Paragraph 8 of the Protocol to the Treaty stipulates that a specific 30-year record of streamflows be used for calculating downstream power benefits. The Entities have been using this 30-year record for part of the downstream benefit calculations but have updated and extended the record for general use and have been using the updated record for the specified 30-year period to develop Assured Operating Plans. In its previous Annual Report the Board stated that the updated 30-year record should be used to calculate the Downstream Power Benefits as well as to develop the Assured Operating Plans. The Board advised the Entities accordingly and noted that this position should be reflected in the document "Columbia River Treaty, Principles and Procedures for Preparation and Use of Hydroelectric Operating Plans".

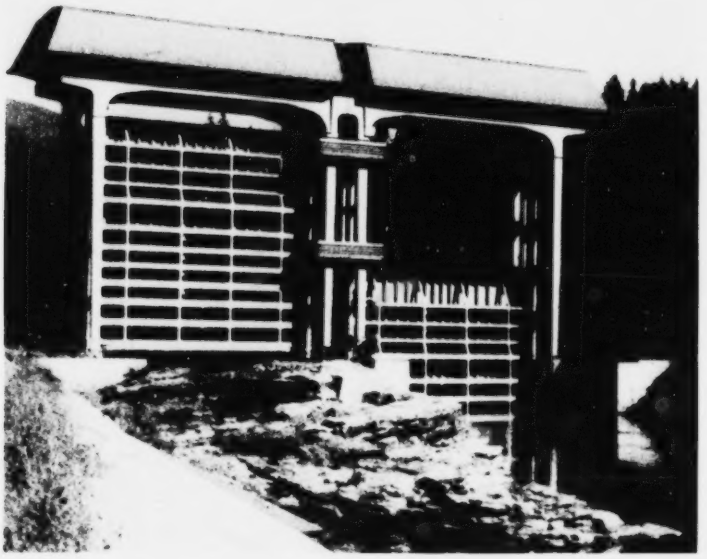
The Assured Operating Plan for operating year 1989-90, received by the Board early in the report year, includes generation at the Mica and Revelstoke projects in Canada and is based on the operation of the system for optimum generation in both countries. This Plan is essentially the same as the Plan for the preceding operating year. The Assured Operating Plan for operating year 1990-91 was received from the Entities after the end of the report year.

Early in this report year the Entities provided the Board with the Detailed Operating Plan for Canadian Treaty storage and Libby reservoir for the operating year ending 31 July 1985. The Detailed Operating Plan for the operating year ending 31 July 1986 was forwarded to the Board after the end of the report year. These plans contain criteria for operating the Arrow, Duncan, Mica and Libby reservoirs.

In April 1984, the Entities reached an agreement relating to the initial filling of non-Treaty reservoirs, the use of non-Treaty storage, and Mica and Arrow reservoir refill

enhancement. The agreement and associated contracts between Bonneville Power Administration and British Columbia Hydro and Power Authority, and between Bonneville Power Administration and Mid-Columbia Purchasers, have been reviewed. The Board finds that these agreements do not interfere with Treaty operations and are consistent with Treaty objectives.

The Northwest Power Planning Council was established by Act of Congress in 1980 to prepare a program for improvement of fish and wildlife in the Columbia River Basin and to develop a conservation and electric power plan for the Pacific Northwest. The Council,



CANAL GATES
Kootenay Canal power project in British Columbia.

on 15 November 1982, adopted the Columbia River Basin Fish and Wildlife Program which establishes a water budget. This budget reserves 3.45 million acre-feet of storage upstream from Priest Rapids Dam on the Columbia River and 1.19 million acre-feet upstream from Lower Granite Dam on the Snake River. This storage is used by United States' project operators when it is required to improve low flows in the main rivers during the downstream migration of anadromous fish. Fisheries and native Indian interests control use of the storage for this purpose. The use of Canadian Treaty storage is advocated by the United States Northwest Power Planning Council in its Fish and Wildlife Program.

The Entities have agreed to study the issues affecting future development of Assured Operating Plans, including water budget and updated streamflows, and to report on results. The Board has stated that the Assured Operating Plans are for optimum operation for power and flood control benefits. The Board noted, however, that the Entities could agree to provide water for fish migration under detailed operating arrangements providing this does not conflict with Treaty requirements and that such arrangements must not result in any decrease to Canadian downstream power or flood control benefits. The Board advised the Entities of this position.

Annual Calculation of Downstream Benefits

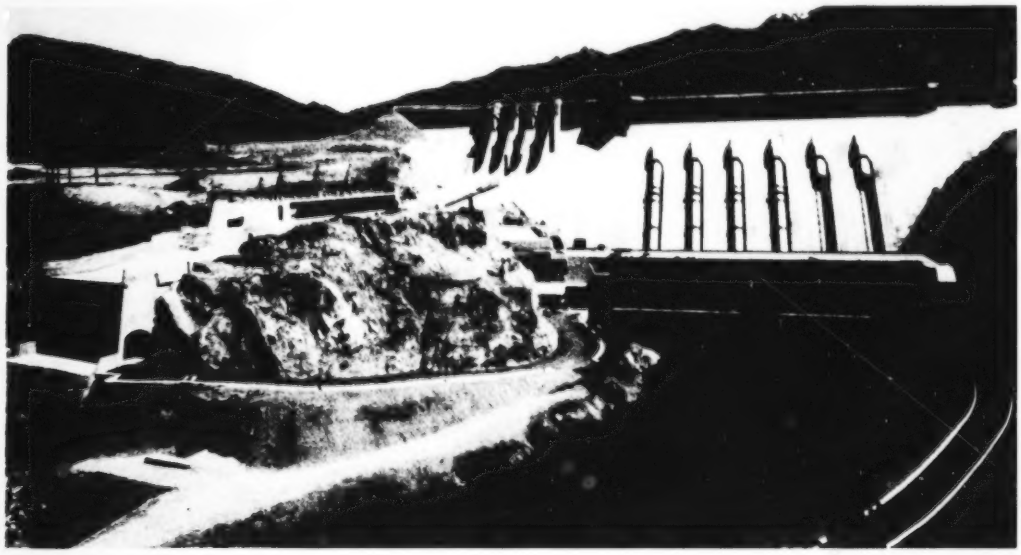
The general requirements for determination of assured operating plans and downstream power benefits are summarized in the first paragraph of the preceding section.

In this report year the Entities provided the Board with a copy of their agreed document outlining downstream power benefits resulting from Canadian storage for the operating year 1989-90. Copies of the three computer studies used in the final calculations for the determination of downstream benefits, and which also provide the basis of the hydroelectric operating plan, are available to the Board. It is noted that updated streamflows, as discussed in the preceding section of this report, were only used for part of the downstream benefit calculations and that the Entities have agreed to study the effects of the use of such flows. A report on determination of downstream power benefits for the operating year 1990-91 was received from the Entities after the end of the report year. The Board notes that the updated streamflows have not been used as the Entities are still pursuing their studies.

Flood Control Operating Plans

The Treaty provides that Canadian storage reservoirs will be operated by the Canadian Entity in accordance with operating plans designed to minimize flood damage in the United States and Canada.

The Columbia River Treaty Flood Control Operating Plan defines flood control operation of the Duncan, Arrow, Mica and Libby reservoirs. This plan was received from the Entities and reviewed by the Board in the 1972-73 report year and is still in effect.



REVELSTOKE DAM inaugurated in 1985.

Flow Records

Article XV (2)(a) of the Treaty specified that the Permanent Engineering Board shall assemble records of flows of the Columbia and Kootenay Rivers at the Canada-United States of America boundary. Flows for this report year are tabulated in Appendix C for the Kootenai River at Porthill, Idaho and for the Columbia River at Birchbank, British Columbia.

OPERATION

General

The Columbia River Treaty Operating Committee was established by the Entities to develop operating plans for the Treaty storages and to direct operation of these storages in accordance with the terms of the Entity agreements.

During the report year the Treaty storage in Canada was operated by the Canadian Entity in accordance with:

— Columbia River Treaty Flood Control Operating Plan

— Detailed Operating Plan for Columbia River Treaty Storage 1 August 1984 through 31 July 1985

— Detailed Operating Plan for Columbia River Treaty Storage 1 August 1985 through 31 July 1986

— Columbia River Treaty Hydroelectric Operating Plan, Assured Operating Plan for Operating Year 1984-85

— Columbia River Treaty Hydroelectric Operating Plan, Assured Operating Plan for Operating Year 1985-86.

In addition, one other agreement was in effect during this period:

— An agreement between the Entities dated 9 April 1984 relating to:

  — Agreement between British Columbia Hydro and Power Authority and Bonneville Power Administration Relating to: (1) Initial Filling of

Non-Treaty Reservoirs, (2) The Use of Columbia River Non-Treaty Storage and (3) Mica and Arrow Reservoir Refill Enhancement

— Contract between Bonneville Power Administration and Mid-Columbia Purchasers Relating to Federal and Canadian Columbia River Storage.

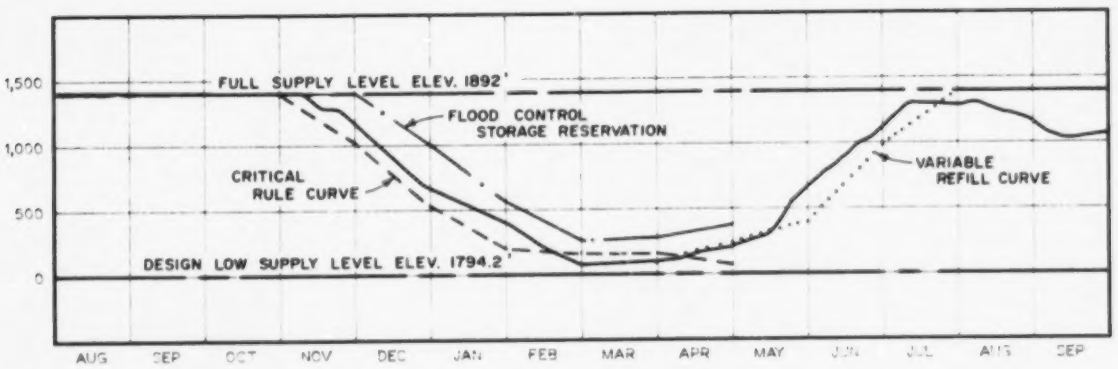
Power Operation

The three Canadian Treaty reservoirs, Duncan, Arrow and Mica, and the Libby reservoir in the United States were in full operation throughout this report year.

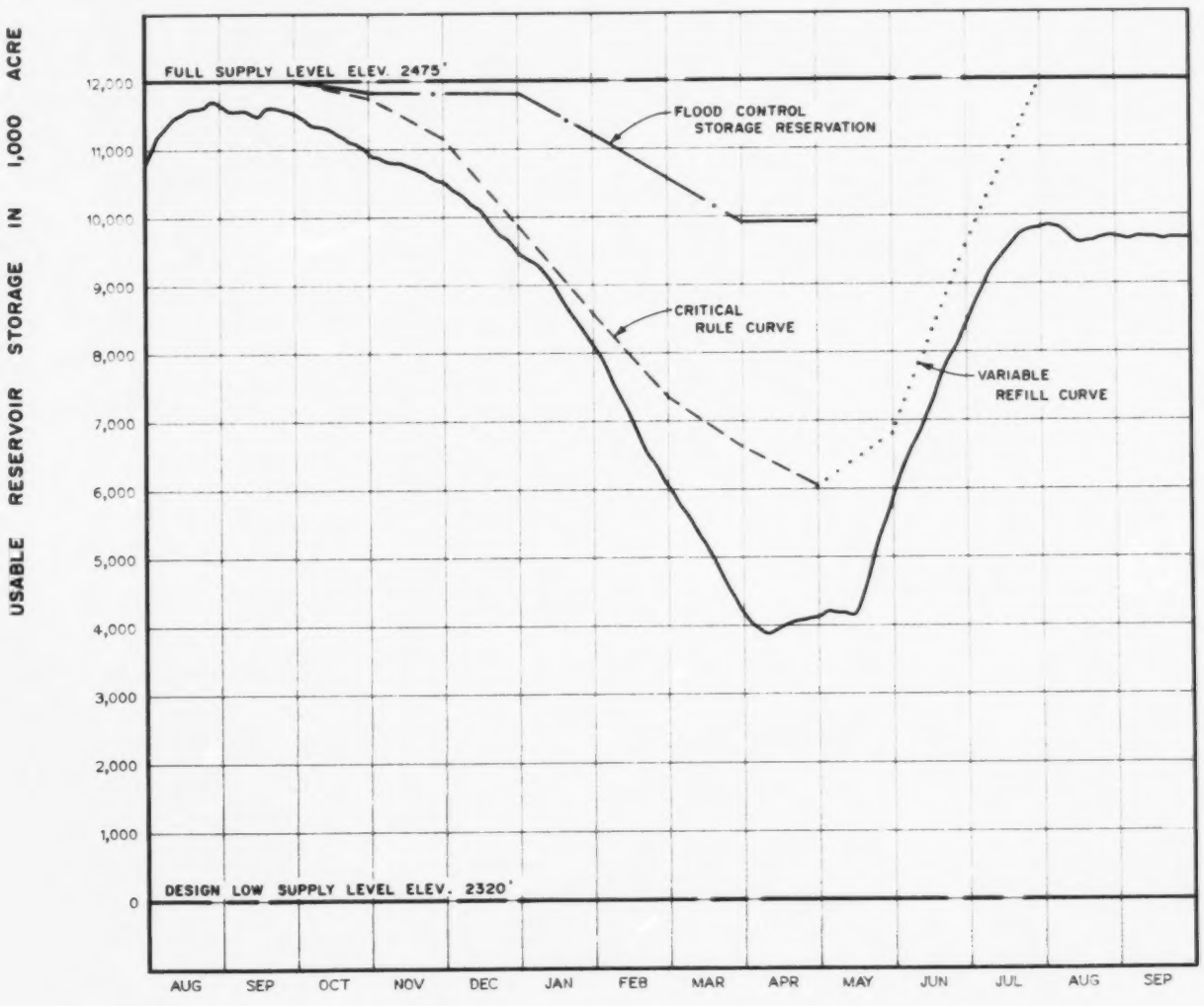
All power reservoirs in the Columbia River System were essentially full after the 1984 freshet. At the beginning of the report year, all Canadian Treaty storages were full and drafting of Libby reservoir had begun. The normal drawdown for power purposes occurred through the winter until the end of January when discharges were reduced over concern about refilling the reservoirs.

The 1985 freshet volume was below average at Treaty projects. Mica and Arrow reservoirs filled during the freshet and remained full until the end of September. Duncan and Libby reservoirs did not fill and drafting began at both before the end of September.

Storage was transferred between Mica and Arrow reservoirs and into Revelstoke storage accounts as permitted under the Entities Storage Agreement of April, 1984. These storage transfers were accomplished without disrupting Treaty operations.

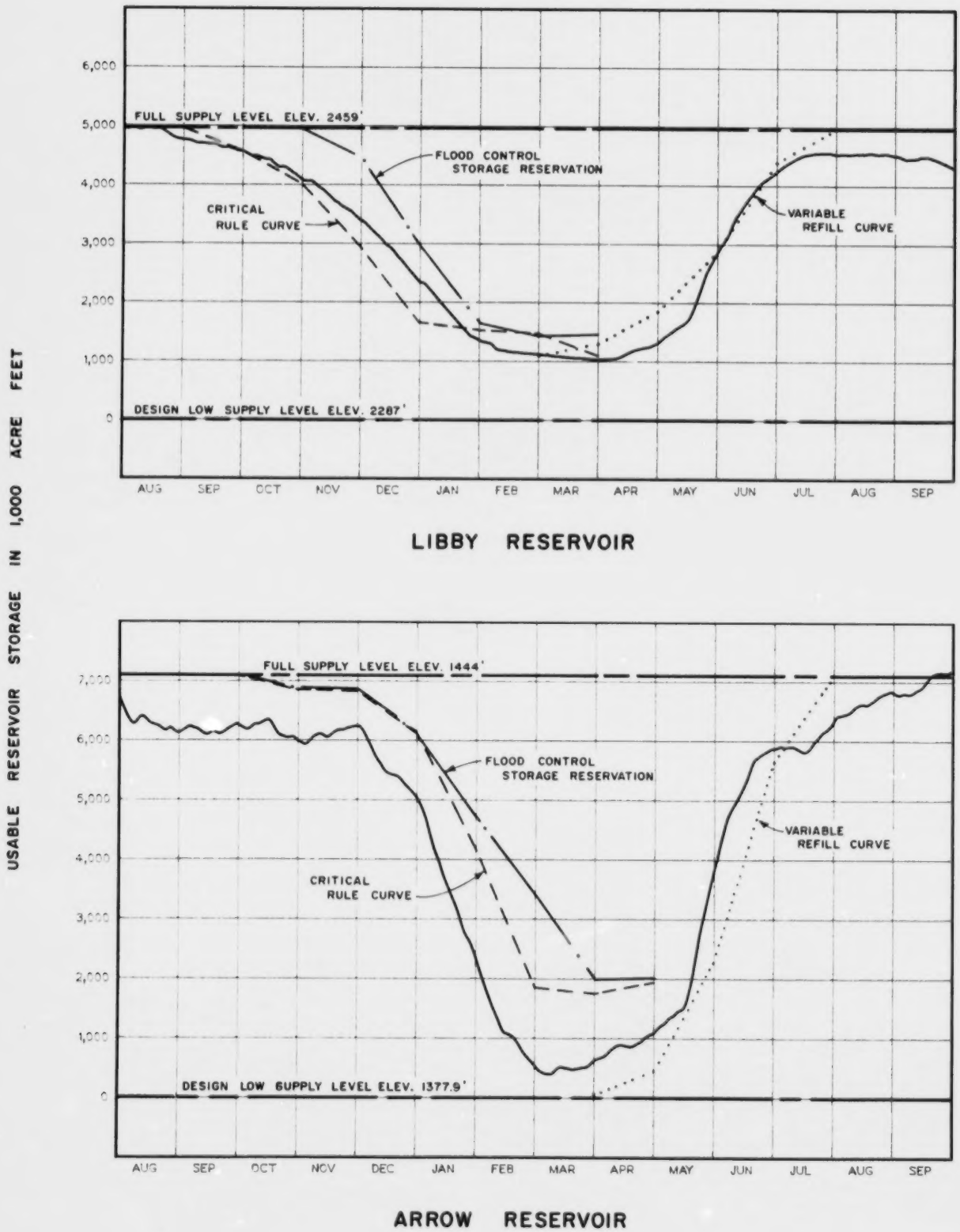


DUNCAN RESERVOIR



MICA RESERVOIR

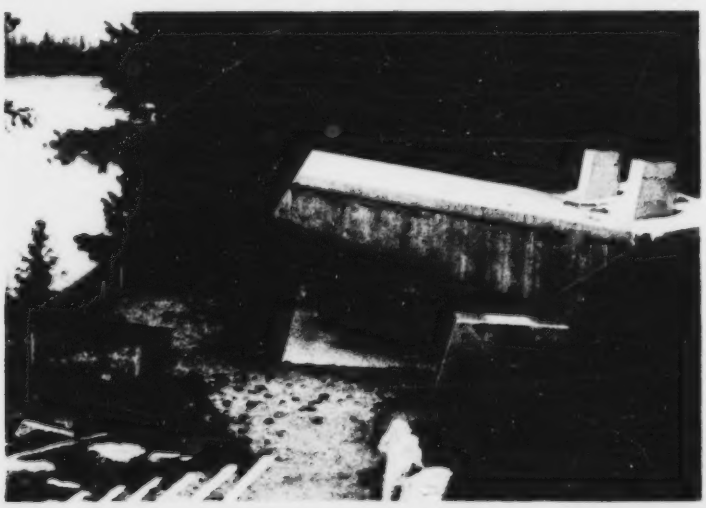
HYDROGRAPHS — Duncan and Mica reservoir levels for the 14-month period ending 30 September 1985.



HYDROGRAPHS — Libby and Arrow reservoir levels for the 14-month period ending 30 September 1985.

Commencing in the previous report year, operation in the United States incorporated requirements of the Northwest Power Planning Council's Fish and Wildlife Program. This program specifies a water budget for use during the period 15 April to 15 June to meet minimum flow requirements for the downstream migration of anadromous fish. In this report year the water budget of 3.45 million acre-feet for Priest Rapids on the Columbia River was fully utilized between 15 April and 15 June.

Operation of the reservoirs is illustrated on pages 29 and 30 by hydrographs which show actual reservoir levels and some of the more important rule curves which govern operation of the Treaty storages. The Flood Control Storage Reservation curve specifies maximum month-end reservoir levels which will permit evacuation of the reservoir to control the forecasted freshet. The Critical Rule Curve shows minimum month-end reservoir levels which should be maintained to enable the anticipated power demands to be met under adverse water supply conditions. The Variable Refill Curve shows reservoir elevations necessary to ensure refilling the reservoir by the end of July with a reasonable degree of confidence. Similar rule curves which apply to operation of the combined Canadian Treaty storages have also been provided to the Board.



PICNIC SHELTER
at Libby Dam
recreation area.

Duncan reservoir was full at elevation 1892 feet at the beginning of the report year. Drafting of storage began in November and continued at varying rates throughout the winter until the minimum elevation for the year of 1802.9 feet was reached on 2 March 1985. On 3 March discharge was reduced to 100 cfs and the reservoir began to fill. The reservoir continued to fill with generally below normal inflows until 14 July when inflows were passed to help fill other reservoirs. Duncan reservoir reached peak elevation of 1886.8 feet on 7 August, then drafting began again and by the end of September the reservoir was down to elevation 1872.5 feet.

Although Arrow reservoir began the report year six and one-half feet below normal full pool elevation, its Treaty storage was considered full because some storage was temporarily held in Revelstoke reservoir. Until the end of December, reservoir levels followed the flood control rule curve. The reservoir was drafted heavily during January and February with discharges as high as 96,900 cfs. Treaty storage was fully drafted by 20 March 1985. Minimum reservoir elevation was 1381.6 feet on 8 March.

Refill began in April. Although inflows were below normal during the refill period, the reservoir filled rapidly. By early July, after it was recognized that all Columbia River system reservoirs would not fill in the summer, Arrow discharge was increased to help fill major reservoirs downstream and levels remained nearly constant until 20 July. Filling then resumed, and on 30 September Arrow reservoir was at elevation 1444.5 feet, slightly above normal full pool.

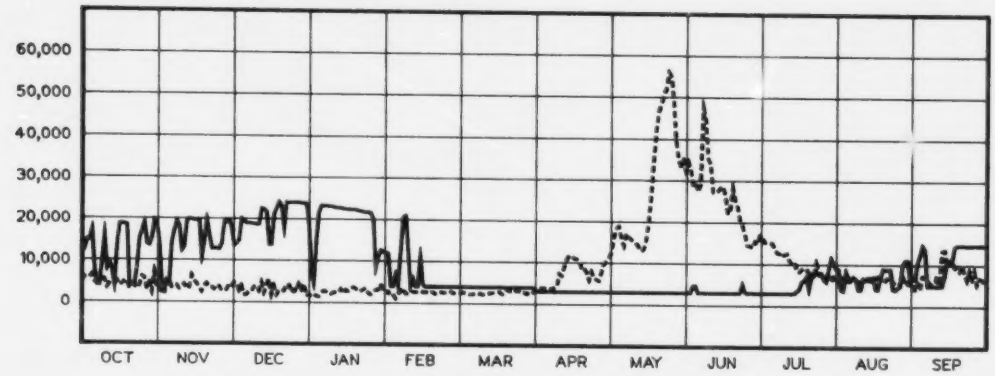
At the beginning of the report year Mica reservoir was at elevation 2470.6 feet, four and a half feet below full pool level. During October through December, Treaty storage at Mica was operated generally in accordance with the Detailed Operating Plan, although some departures from the planned discharges at Mica occurred because transfers of non-Treaty storage took place into and out of various storage accounts under the non-Treaty storage agreement of April 1984. During the period January through March 1985 drafting continued and on 12 April, Mica reservoir reached 2385.9 feet elevation, its lowest level of the year.

Inflows to Mica reservoir were below normal during most of the freshet period. Refill continued until Treaty storage space was filled by 25 July. The reservoir level was then at elevation 2453 feet, twenty-two feet below its full pool level, because some non-Treaty storage space was empty. A peak level of 2454.1 feet was reached on 5 August 1985. During August and September some storage was released from non-Treaty storage, drafting the reservoir to elevation 2452 feet by 30 September.

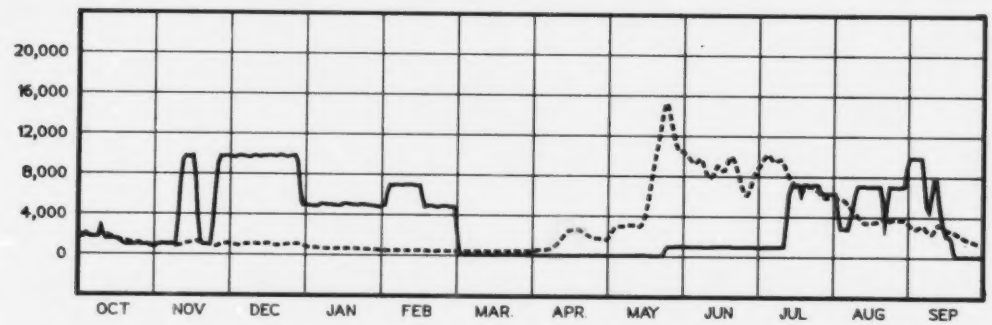
Libby reservoir began the operating year 8.8 feet below its normal full pool level, with drafting of storage already underway. Drafting continued at a high rate until the end of January 1985, when discharges were reduced to minimum flows of 3,000 cfs. As inflows increased the reservoir began its refill which continued until late June. When it became apparent that the coordinated reservoir system would not refill, discharge was increased to help fill downstream reservoirs. The reservoir reached its peak elevation of 2449.9 feet, 9.1 feet below full pool, on 28 July. The reservoir was held at a constant elevation throughout August, then drafting was continued to bring the reservoir level to elevation 2444.3 feet at the end of the report year.

Flood Control Operation

Because of lower than expected freshet runoff volumes, it was not necessary to operate the Columbia reservoir system on daily flood control operation during the 1985 freshet. Minor flood control was provided by normal refill operation of the Treaty reservoirs and other reservoirs in the Columbia River system.

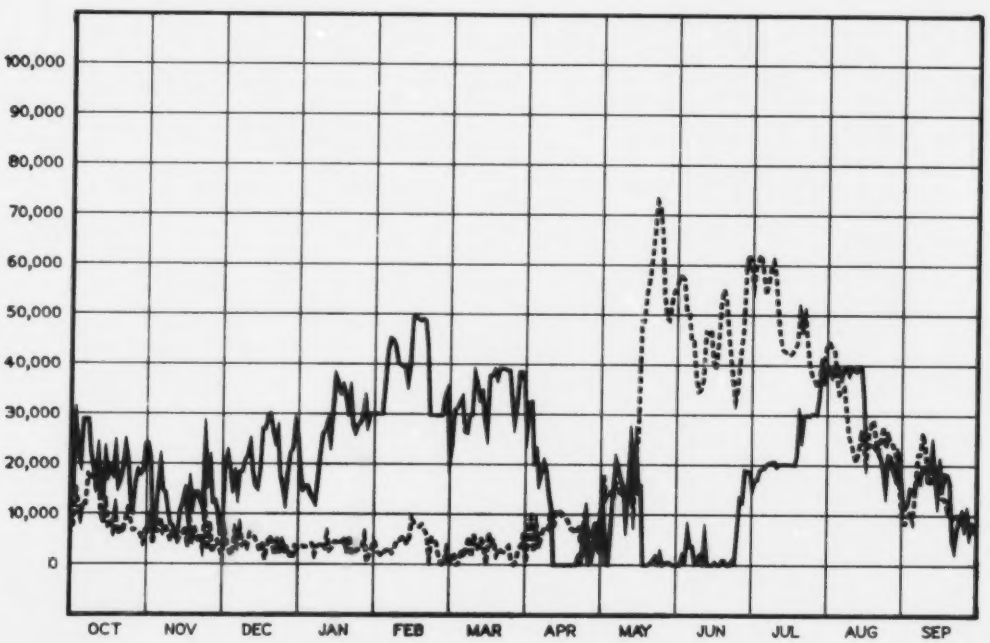


KOOTENAI RIVER AT LIBBY DAM

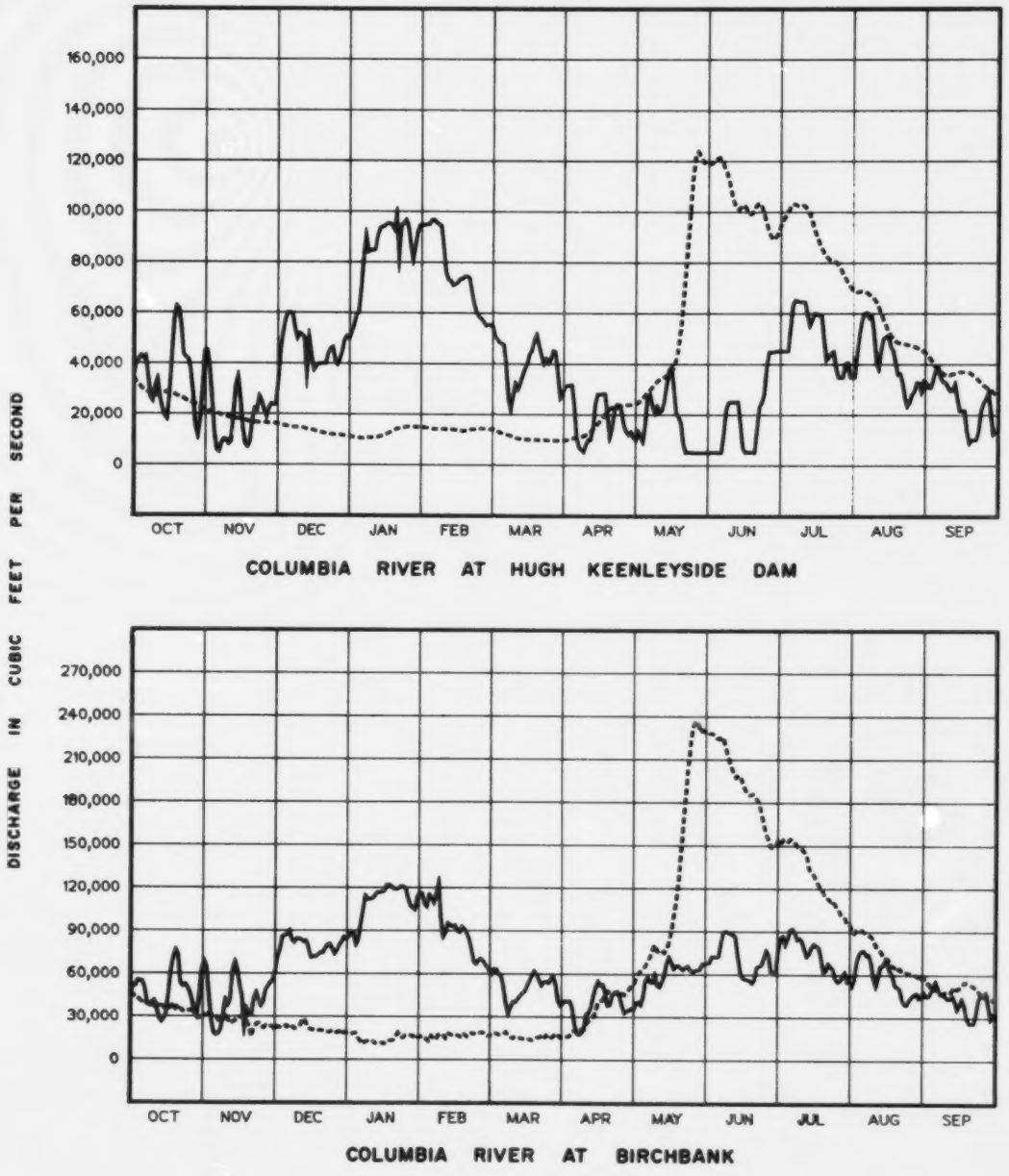


DUNCAN RIVER AT DUNCAN DAM

DISCHARGE IN CUBIC FEET PER SECOND



COLUMBIA RIVER AT MICA DAM



HYDROGRAPHS — Observed and pre-project flows for year ending 30 September 1985.

BENEFITS

Flood Control Provided

Without regulation by upstream reservoirs the 1985 freshet would have produced a below average peak discharge at Trail, British Columbia and at The Dalles, Oregon, and would have caused only minor flood damage in either country.

It is estimated that the Duncan and Libby projects reduced the peak stage on Kootenay Lake by about six feet and that the Duncan, Arrow, Mica and Libby projects reduced the peak stage of the Columbia River at Trail, British Columbia by about fourteen feet. The effect of storage in the Duncan, Arrow, Mica and Libby reservoirs on flows at the sites and on flows of the Columbia River at Birchbank is illustrated on page 34 by hydrographs which show both the actual discharges and the flows that would have occurred if the dams had not been built. It is noted that the hydrograph showing pre-project conditions for Birchbank has been computed on the assumption that the effects of Duncan, Arrow, Mica and Libby regulation and of the regulation provided by the Corra Linn development on Kootenay Lake have been removed.

The operation of Columbia Basin reservoirs for the system as a whole reduced the natural annual peak discharge of the Columbia River near The Dalles, Oregon from about 550,000 cfs to 279,000 cfs. Regulation by the Treaty storage projects during the 1985 freshet period contributed only minor flood control benefits in Canada and the United States.

All payments required by Article VI(1) as compensation for flood control provided by the Canadian Treaty storage projects have been made by the United States to Canada; the final payment was made on 29 March 1973 when the Mica project was declared operational.

Power Benefits

Downstream power benefits in the United States which arise from operation of the Canadian Treaty storage were pre-determined for the first thirty years of operation of each project and the Canadian one-half share was sold in the United States under the terms of the Canadian Entitlement Purchase Agreement. The United States Entity delivers capacity and energy to Columbia Storage Power Exchange participants as purchasers of the Canadian Entitlement. The benefits of additional generation made possible on the Kootenay River in Canada as a result of regulation provided by Libby, and generation at the Mica and Revelstoke projects, are retained wholly within Canada. The benefits from Libby regulation which occur downstream in the United States are not shareable under the Treaty.

Other Benefits

In previous report years, by agreement between the Entities, streamflows have been regulated for non-power purposes such as accommodating construction in river channels and providing water to assist the downstream migration of juvenile fish in the United States. These arrangements were supplemental to Treaty operating plans. In this report year similar arrangements were made.

CANOE RACE
near Libby Dam.

CONCLUSIONS

1. The Duncan, Arrow, Mica and Libby projects have been operated in conformity with the provisions of the Treaty. Operation also reflected detailed operating plans developed by the Entities, the flood control operating plan for Treaty reservoirs, and an agreement between the Entities relating to the use of non-Treaty storage and refill enhancement of Mica and Arrow reservoirs. Operation under the agreement did not conflict with normal Treaty operations.

2. Entity evaluations pertaining to development of the hydrometeorological network, power operating plans, and the annual calculation of downstream power benefits are proceeding. The Entities are studying issues which affect development of the Assured Operating Plans and the determination of the Downstream Power Benefits including water budget and updated streamflows, and will report results.

3. The objectives of the Treaty are being met.

APPENDIX A

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

United States	Canada
Members	
Mr. Lloyd A. Duscha, Chairman Deputy Director, Engineering & Construction Directorate, Headquarters, U.S. Army Corps of Engineers, Washington, D.C.	Mr. G.M. MacNabb, Chairman President, Natural Sciences & Engineering Research Council Canada, Ottawa, Ontario
Mr. J. Emerson Harper Acting Director, Office of Power Marketing Coordination, Department of Energy, Washington, D.C.	Mr. B.E. Marr Deputy Minister, Ministry of Environment, Victoria, B.C.
Alternates	
Mr. Alex Shwaiko 4630 North 20th Street, Arlington, Virginia	Mr. E.M. Clark Regional Director, Pacific and Yukon Region, Inland Waters Directorate, Department of the Environment, Vancouver, B.C.
Mr. Thomas L. Weaver Assistant Administrator for Engineering, Western Area Power Administration, Department of Energy, Golden, Colorado	Mr. H.M. Hunt Manager, Power and Special Projects Section, Ministry of Environment, Victoria, B.C.
Secretaries	
Mr. S.A. Zanganeh Hydraulics & Hydrology Division, Civil Works Directorate, Headquarters, U.S. Army Corps of Engineers, Washington, D.C.	Mr. E.M. Clark Regional Director, Pacific and Yukon Region, Inland Waters Directorate, Department of the Environment, Vancouver, B.C.

APPENDIX A

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

Record of Membership

Members

United States		Canada	
Mr. Wendell E. Johnson 1)	1964-1970	Mr. G.M. MacNabb 1)	1964-
Mr. Morgan E. Dubrow	1964-1970	Mr. A.F. Paget	1964-1973
Mr. John W. Neuberger	1970-1973	Mr. V. Raudsepp	1973-1974
Mr. Joseph B. Caldwell 1)	1971-1973	Mr. B.E. Marr	1974-
Mr. Homer B. Willis 1)	1973-1979		
Mr. C. King Mallory	1973-1975		
Mr. Raymond A. Peck, Jr.	1976-1977		
Mr. J. Emerson Harper	1978-		
Mr. Lloyd A. Duscha 1)	1979-		

Alternates

Mr. Fred L. Thrall	1964-1974	Mr. E.M. Clark	1964-
Mr. J. Emerson Harper	1964-1978	Mr. J.T. Rothwell	1964-1965
Mr. Alex Shwaiko	1974-	Mr. H.M. Hunt	1966-
Mr. Thomas L. Weaver	1979-		

Secretaries

Mr. John W. Roche	1965-1969	Mr. E.M. Clark	1964-
Mr. Verle Farrow	1969-1972		
Mr. Walter W. Duncan	1972-1978		
Mr. S.A. Zanganeh	1978-		

1) Chairman

APPENDIX B

COLUMBIA RIVER TREATY ENTITIES

United States

Mr. Peter T. Johnson, Chairman

Administrator, Bonneville
Power Administration,
Department of Energy,
Portland, Oregon

Brigadier General George R. Robertson

Division Engineer,
U.S. Army Engineer Division, North Pacific,
Portland, Oregon

Canada

Mr. C.A. Johnson 1)

Chairman, British Columbia
Hydro and Power Authority
Vancouver, B.C.

1) Vice Mr. R.W. Bonner as of 11 January 1985

APPENDIX C

RECORD OF FLOWS

AT THE

INTERNATIONAL BOUNDARY

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6,230	16,900	15,900	16,500	11,600	5,070	5,150	15,000	15,500	5,360	9,540	7,000
2	11,500	15,800	14,300	9,090	5,690	5,030	5,010	16,800	15,700	5,380	9,090	6,650
3	13,500	7,420	14,000	7,120	5,290	4,850	5,420	21,000	16,100	5,940	8,890	6,620
4	14,600	6,310	18,000	18,300	5,100	4,870	6,480	22,300	15,100	6,050	10,900	10,600
5	14,600	6,030	19,400	22,400	5,500	4,940	6,640	20,200	15,300	5,840	5,300	12,400
6	15,400	6,050	19,800	23,300	7,220	4,970	6,580	17,300	15,100	5,460	8,310	14,200
7	8,850	16,000	20,100	22,400	10,100	4,890	6,590	15,600	17,000	5,580	7,030	12,300
8	5,560	19,300	20,200	22,300	12,800	4,860	6,580	15,700	23,100	5,440	6,710	6,760
9	5,280	20,600	20,000	23,500	13,600	4,770	6,940	15,700	22,500	5,220	6,860	6,420
10	10,200	17,200	20,600	24,100	8,200	4,650	8,070	15,600	18,800	5,000	7,080	6,180
11	14,700	14,400	20,600	23,800	6,680	4,790	9,980	15,000	16,400	4,770	5,430	5,810
12	9,380	17,800	21,300	23,800	6,300	4,790	12,600	14,100	14,700	4,610	5,290	5,690
13	9,600	21,300	23,500	23,900	6,270	4,760	14,600	13,200	13,800	4,600	6,920	6,240
14	8,240	22,000	23,700	23,700	5,660	4,780	15,900	12,900	12,900	4,700	6,790	6,260
15	5,830	22,000	20,900	23,700	10,300	4,860	18,000	13,700	11,900	4,470	7,020	8,910
16	16,300	21,600	15,800	23,600	6,050	4,810	18,800	15,900	11,300	4,470	7,220	10,200
17	19,200	21,500	15,900	23,500	5,170	4,770	18,300	19,100	10,700	5,480	7,300	11,200
18	19,500	20,000	23,600	23,500	5,190	4,810	17,300	22,000	9,910	5,300	5,330	13,800
19	19,600	11,900	23,600	23,600	5,260	4,910	15,700	25,000	9,340	6,480	5,120	15,100
20	16,400	18,500	25,000	23,400	4,920	4,960	13,800	27,500	9,080	6,930	6,980	15,200
21	6,670	20,000	19,700	23,300	5,000	5,030	12,000	28,000	8,870	7,330	8,580	15,100
22	5,560	16,300	23,800	23,300	4,940	4,890	10,700	27,900	8,420	5,340	8,860	15,200
23	5,400	14,700	24,800	23,000	4,730	5,080	9,780	27,100	7,880	7,140	8,950	15,000
24	11,900	14,300	25,000	23,000	4,700	5,070	8,930	26,400	7,660	7,910	8,810	15,000
25	15,800	14,100	25,100	23,100	4,760	5,090	8,340	25,100	8,670	8,400	5,220	15,200
26	18,200	14,100	25,100	23,200	4,790	5,330	7,930	22,700	7,260	8,270	5,120	15,100
27	17,200	18,500	25,000	18,700	4,940	5,260	7,810	19,900	6,850	8,240	5,350	15,300
28	15,200	20,500	25,100	10,400	4,940	5,210	11,800	18,000	6,590	7,040	5,320	15,100
29	15,200	20,800	25,000	11,500		5,090	14,400	16,600	5,860	6,620	9,350	14,900
30	18,600	20,800	25,100	12,500		4,940	14,600	16,700	5,500	9,570	10,300	14,900
31	20,400		25,000	11,900		5,020		16,200		10,600	10,300	
Mean	12,700	16,600	21,400	20,300	6,630	4,940	10,800	19,300	12,300	6,240	7,400	11,300

KOOTENAI RIVER AT PORTHILL, IDAHO — Daily discharges for the year ending 30 September 1985 in cubic feet per second.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	45,000	68,800	61,700	85,900	116,000	64,100	37,800	36,000	67,500	61,100	55,400	47,900
2	52,200	64,600	72,600	89,400	108,000	61,400	39,600	35,000	67,700	76,300	51,900	45,200
3	51,500	46,300	76,900	88,300	107,000	59,800	41,200	39,800	68,200	85,600	56,900	45,100
4	55,600	27,400	85,700	80,300	115,000	63,600	41,100	40,600	72,400	86,800	58,600	47,700
5	54,700	18,700	86,700	83,300	113,000	63,300	41,500	38,600	72,500	80,900	74,300	52,300
6	54,600	17,300	87,100	94,200	109,000	59,700	36,200	44,000	72,100	85,200	76,600	55,500
7	49,300	18,100	90,000	105,000	115,000	59,100	24,800	55,300	72,700	91,100	77,000	50,800
8	39,300	21,300	83,400	114,000	123,000	51,200	18,800	57,900	82,700	92,300	73,900	46,600
9	37,900	29,700	81,700	112,000	98,000	38,800	17,800	54,600	89,600	89,600	74,000	46,500
10	39,800	41,800	84,300	112,000	85,700	32,000	18,900	54,300	90,200	84,400	68,500	45,400
11	41,300	38,100	84,300	113,000	88,900	36,600	22,900	60,000	89,200	85,600	57,300	43,300
12	36,500	41,700	83,700	115,000	95,400	40,500	32,100	52,300	88,600	83,700	51,900	43,500
13	28,400	62,200	82,400	117,000	93,800	40,200	33,100	51,200	87,700	77,600	58,700	45,400
14	26,200	68,100	82,800	117,000	93,000	42,200	36,900	54,700	86,600	72,700	66,200	42,100
15	28,300	62,600	77,800	117,000	94,000	45,000	45,400	59,400	73,200	74,400	66,600	35,500
16	32,100	51,500	71,200	118,000	89,800	46,500	50,800	67,800	61,800	79,300	69,700	38,900
17	46,700	43,800	72,000	122,000	89,100	47,800	54,900	72,000	57,400	81,500	66,600	43,100
18	62,000	22,300	71,600	122,000	92,900	51,400	52,100	68,500	57,000	80,100	62,500	38,800
19	71,600	35,200	73,100	121,000	91,100	54,900	53,100	63,900	56,400	79,100	59,100	29,600
20	76,600	31,200	74,800	119,000	88,100	59,100	46,600	65,900	55,800	72,300	52,500	26,200
21	73,500	30,900	74,400	119,000	84,200	62,100	38,100	66,100	54,100	62,000	51,400	26,100
22	53,300	43,100	77,300	119,000	77,400	60,100	38,600	64,500	56,400	63,000	50,100	26,100
23	51,300	47,000	80,300	121,000	68,200	55,700	45,300	63,400	65,000	68,000	42,200	33,100
24	52,800	41,200	80,900	121,000	66,600	52,000	47,300	65,100	66,000	65,700	39,400	43,200
25	50,600	37,600	77,100	120,000	69,700	54,200	46,500	66,200	66,800	64,000	39,400	45,600
26	46,800	40,500	73,900	113,000	70,700	54,900	45,300	62,900	71,200	57,100	42,600	45,900
27	40,600	49,000	76,400	107,000	69,300	53,500	38,100	61,700	76,500	54,900	44,300	47,700
28	32,500	51,100	79,700	106,000	66,000	57,000	32,900	62,900	73,900	55,800	46,200	39,000
29	31,800	54,000	82,400	105,000		58,600	34,200	63,100	61,100	58,800	47,300	29,300
30	44,600	55,600	85,500	114,000		52,200	34,700	63,300	61,000	61,800	43,800	33,100
31	63,200		84,300	117,000		41,200		67,300		55,200	46,100	
Mean	47,400	42,000	79,200	110,000	92,100	52,200	38,200	57,400	70,700	73,700	57,500	41,300

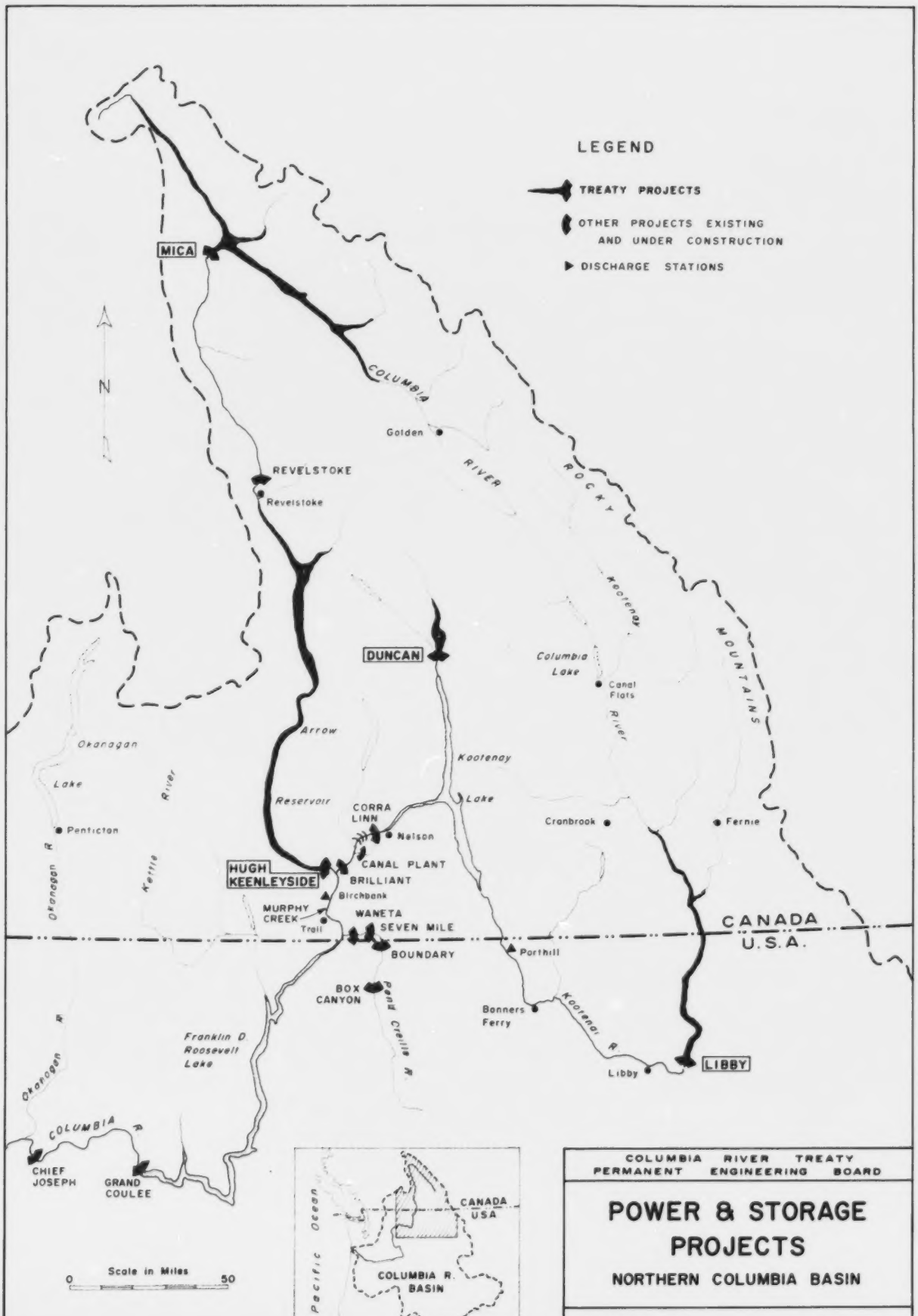
COLUMBIA RIVER AT BIRCHBANK, B.C. — Daily discharges for the year ending 30 September 1985 in cubic feet per second.

APPENDIX D

PROJECT INFORMATION

Power and Storage Projects,
Northern Columbia Basin — Plate No. 1

Project Data
Duncan Project — Table No. 1
Arrow Project — Table No. 2
Mica Project — Table No. 3
Libby Project — Table No. 4



COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

POWER & STORAGE PROJECTS

NORTHERN COLUMBIA BASIN

SEPTEMBER, 1985 PLATE NO. 1

TABLE 1

DUNCAN PROJECT

Duncan Dam and Duncan Lake

Storage Project	
Construction began	17 September 1964
Storage became fully operational	31 July 1967
Reservoir	
Normal Full Pool Elevation	1,892 feet
Normal Minimum Pool Elevation	1,794.2 feet
Surface Area at Full Pool	18,000 acres
Total Storage Capacity	1,432,500 ac-ft
Usable Storage Capacity	1,400,000 ac-ft
Treaty Storage Commitment	1,400,000 ac-ft
Dam, Earthfill	
Crest Elevation	1,907 feet
Length	2,600 feet
Approximate height above riverbed	130 feet
Spillway — Maximum Capacity	47,700 cfs
Discharge Tunnels — Maximum Capacity	20,000 cfs
Power Facilities	
None	

TABLE 2

ARROW PROJECT

Hugh Keenleyside Dam and Arrow Lakes

Storage Project	
Construction began	March 1965
Storage became fully operational	10 October 1968
Reservoir	
Normal Full Pool Elevation	1,444 feet
Normal Minimum Pool Elevation	1,377.9 feet
Surface Area at Full Pool	130,000 acres
Total Storage Capacity	8,337,000 ac-ft
Usable Storage Capacity	7,100,000 ac-ft
Treaty Storage Commitment	7,100,000 ac-ft
Dam, Concrete Gravity and Earthfill	
Crest Elevation	1,459 feet
Length	2,850 feet
Approximate height above riverbed	170 feet
Spillway — Maximum Capacity	240,000 cfs
Low Level Outlets — Maximum Capacity	132,000 cfs
Power Facilities	
None	

TABLE 3

MICA PROJECT

Mica Dam and Kinbasket Lake

Storage Project	
Construction began	September 1965
Storage became fully operational	29 March 1973
Reservoir	
Normal Full Pool Elevation	2,475 feet
Normal Minimum Pool Elevation	2,320 feet
Surface Area at Full Pool	106,000 acres
Total Storage Capacity	20,000,000 ac-ft
Usable Storage Capacity	
Total	12,000,000 ac-ft
Commitment to Treaty	7,000,000 ac-ft
Dam, Earthfill	
Crest Elevation	2,500 feet
Length	2,600 feet
Approximate height above foundation	800 feet
Spillway — Maximum Capacity	150,000 cfs
Outlet Works — Maximum Capacity	37,400 cfs
Power Facilities	
Designed ultimate installation	
6 units at 434 mw	2,604 mw
Power commercially available	December 1976
Presently installed	
4 units at 434 mw	1,736 mw
Head at full pool	600 feet
Maximum Turbine Discharge	
of 4 units at full pool	38,140 cfs

TABLE 4

LIBBY PROJECT

Libby Dam and Lake Koocanusa

Storage Project	
Construction began	June 1966
Storage became fully operational	17 April 1973
Reservoir	
Normal Full Pool Elevation	2,459 feet
Normal Minimum Pool Elevation	2,287 feet
Surface Area at Full Pool	46,500 acres
Total Storage Capacity	5,869,000 ac-ft
Usable Storage Capacity	4,980,000 ac-ft
Dam, Concrete Gravity	
Deck Elevation	2,472 feet
Length	3,055 feet
Approximate height above riverbed	370 feet
Spillway — Maximum Capacity	145,000 cfs
Low Level Outlets — Maximum Capacity	61,000 cfs
Power Facilities	
Designed ultimate installation	
8 units at 105 mw	840 mw
Power commercially available	24 August 1975
Presently installed	
5 units at 105 mw	525 mw
Head at full pool	352 feet
Maximum Turbine Discharge	
of 5 units at full pool	26,500 cfs